

# *Global Precipitation Analysis for Climate and Weather Studies*

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**Project Goal:** To answer the question “How are the characteristics of global precipitation changing in terms of means, variations and extremes, and what is the confidence in our conclusions?”

## **Objectives & deliverables:**

- establish the *climatology of global precipitation*, the mean spatial and seasonal variations, inter-annual variations and the uncertainty of these estimates
- examine *inter-decadal changes* and recent (25-year) *linear changes (trends)* in precipitation (global and regional) and relate these to large-scale forcing (e.g., ENSO, volcano/aerosol impacts)
- develop and analyze a *climatology of precipitation extremes* (and time history thereof)
- continue to *produce, monitor, validate and improve the monthly and daily GPCP* (Global Precipitation Climatology Project) products (in coordination with other scientists and organizations)
- contribute to *integrated water cycle studies on time scales of inter-annual to decadal* through coordination with other NEWS projects

## **Technical approach**

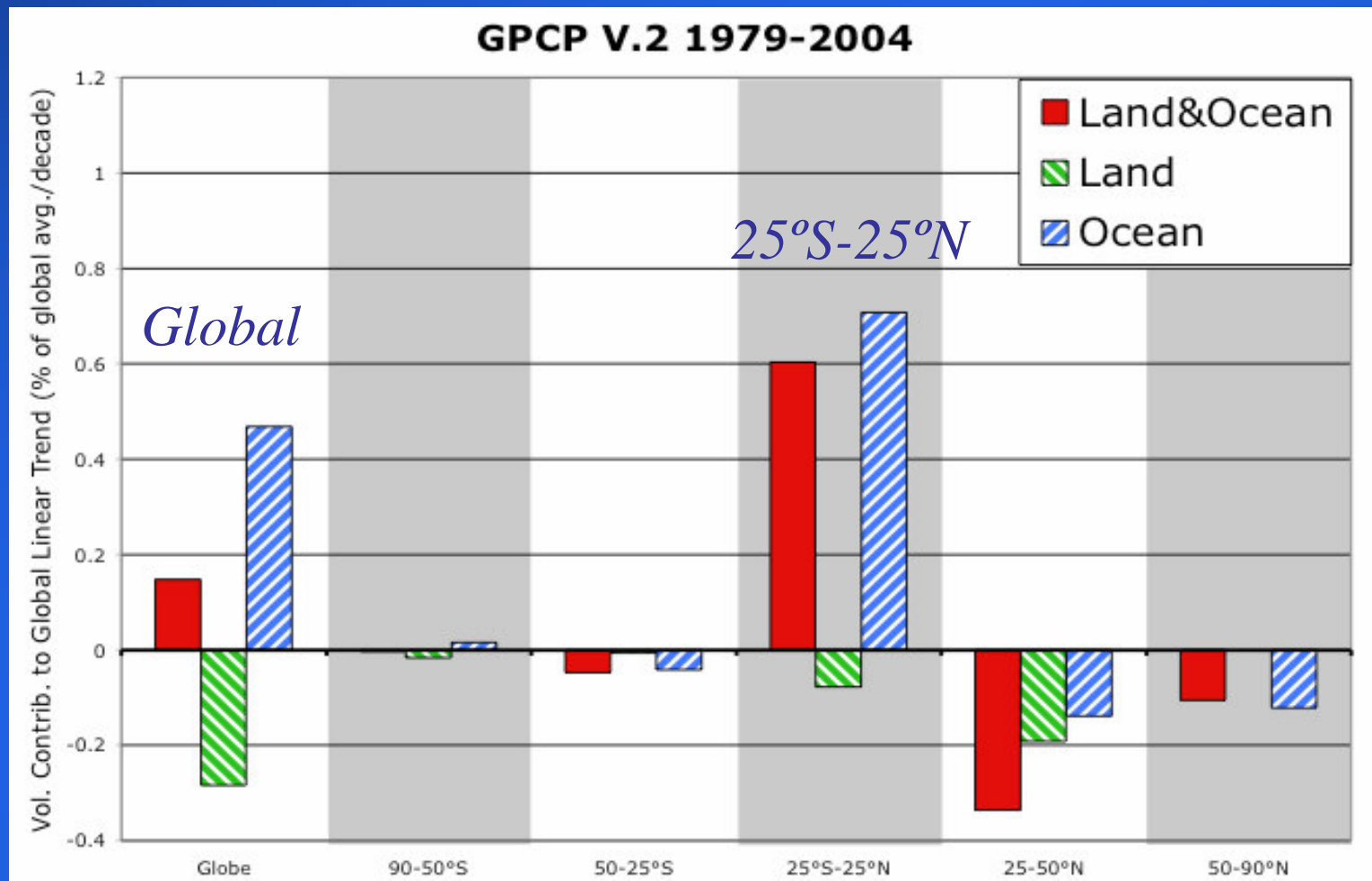
- Climatology of means, seasonal variations, inter-annual variations and uncertainties--establish baseline and uncertainty by comparison with other data sets (both ground and satellite) and examination of data boundaries, etc.. Overlapping TRMM/GPCP period (1998-present) important
- Inter-decadal changes to trends and uncertainties thereof--use parallel precipitation data sets (e.g., TRMM, SSM/I with different algorithms) and other water cycle data sets (collaborative with other NEWS investigators) to analyze, confirm/reject features
- Climatology of precipitation extremes--study distribution of extremes related to ENSO, etc. using 26- year monthly record and shorter-time extremes using GPCP daily product (1997-present) and the TRMM 3-hr Multi-satellite Precipitation Analysis (TMPA). Examine GPCP and other records for change in extremes
- Continue and improve GPCP products--work with GPCP group to design improved technique(s) for global precipitation analyses to meet community requirements (e.g., finer time and space resolution, improved error information, precipitation type, orographic precipitation etc.)

# Global Precipitation Climatology Project (GPCP) 26-year Data Set

*A WCRP/GEWEX Global Data Product*

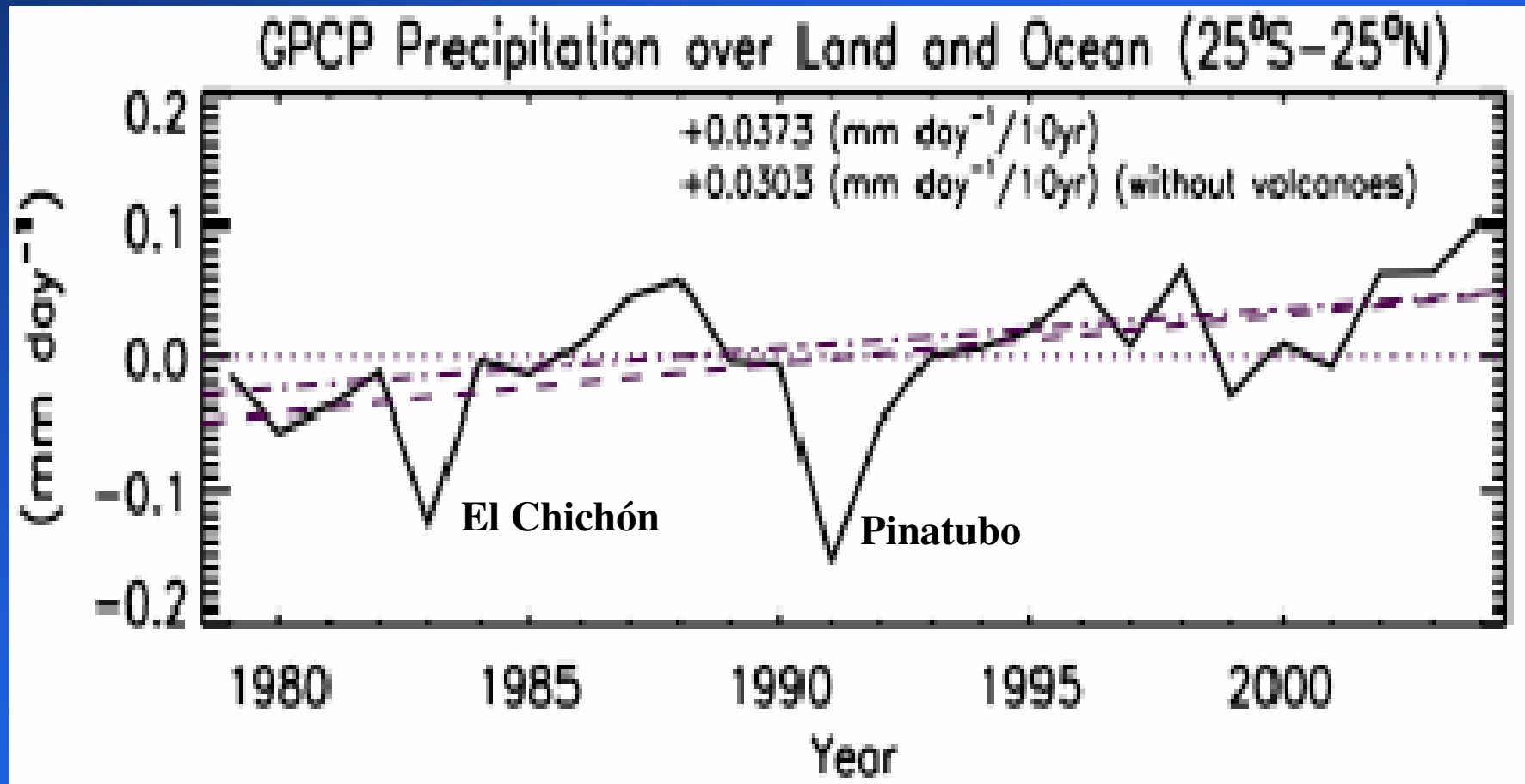
*Adler et al. J. Hydrometeor, 2003.*

Global  
and  
regional  
linear  
changes  
over 26  
years



# GPCP Tropical Variations and Possible Long-term Changes

Impacts of ENSO, Volcanoes, Long-term

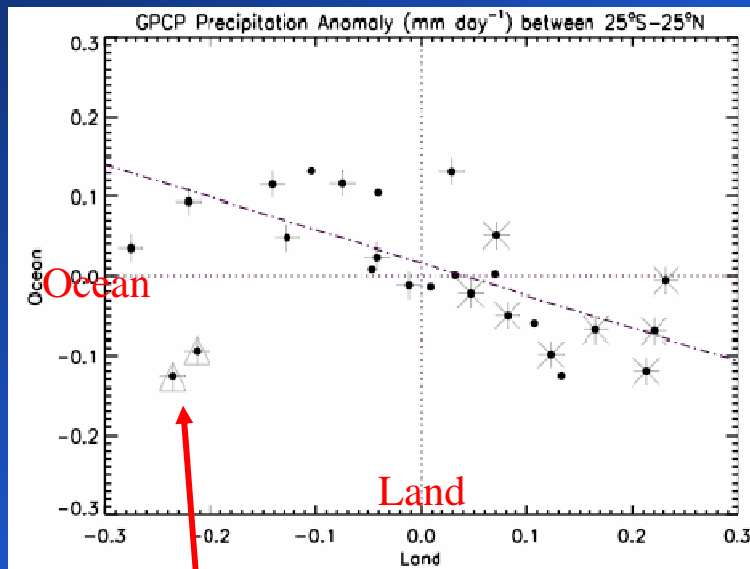


*Fitted line gives 2.5% change over  
period with confidence in 90-95% range*

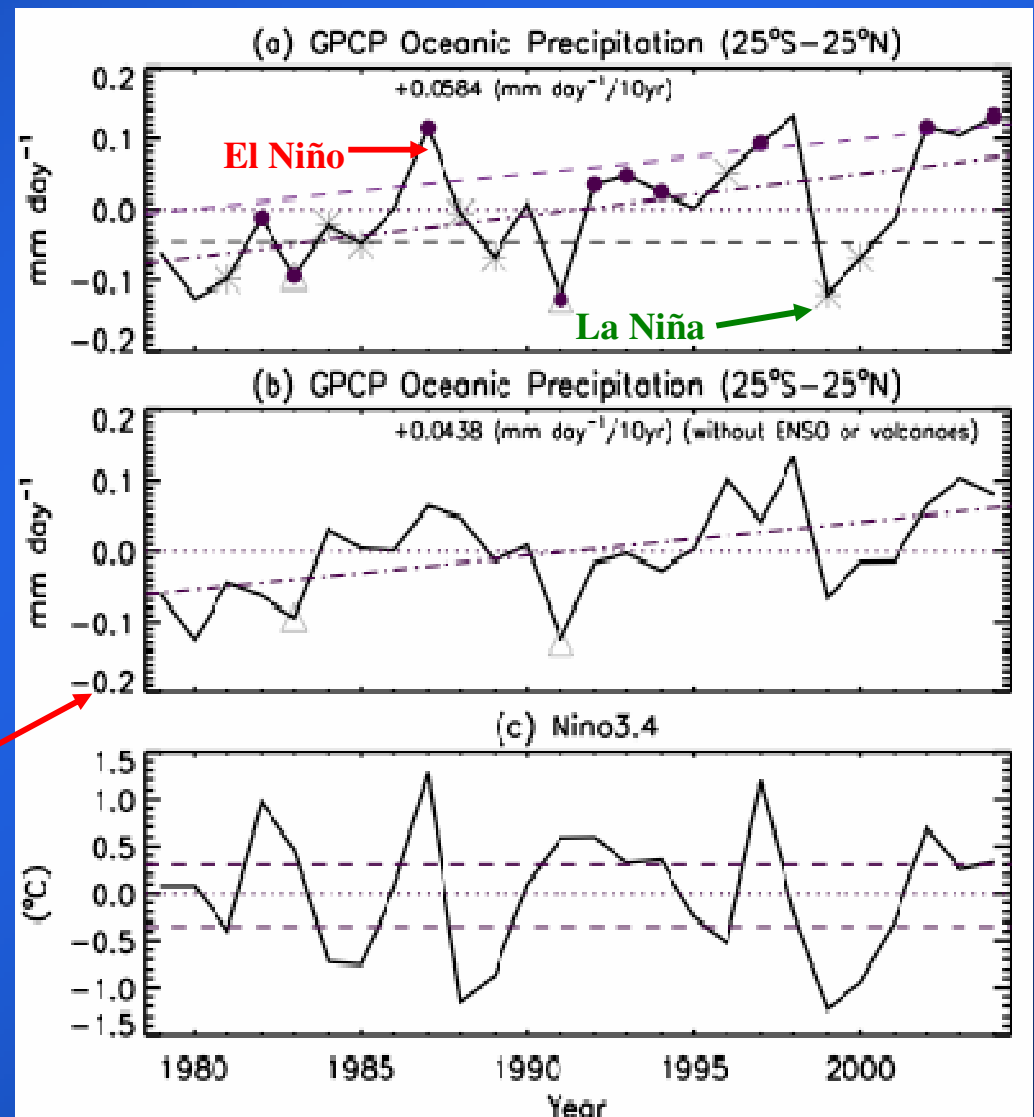
*Volcano impact is 3-5% of  
tropical rain*

# GPCP Tropical Ocean “Trend”

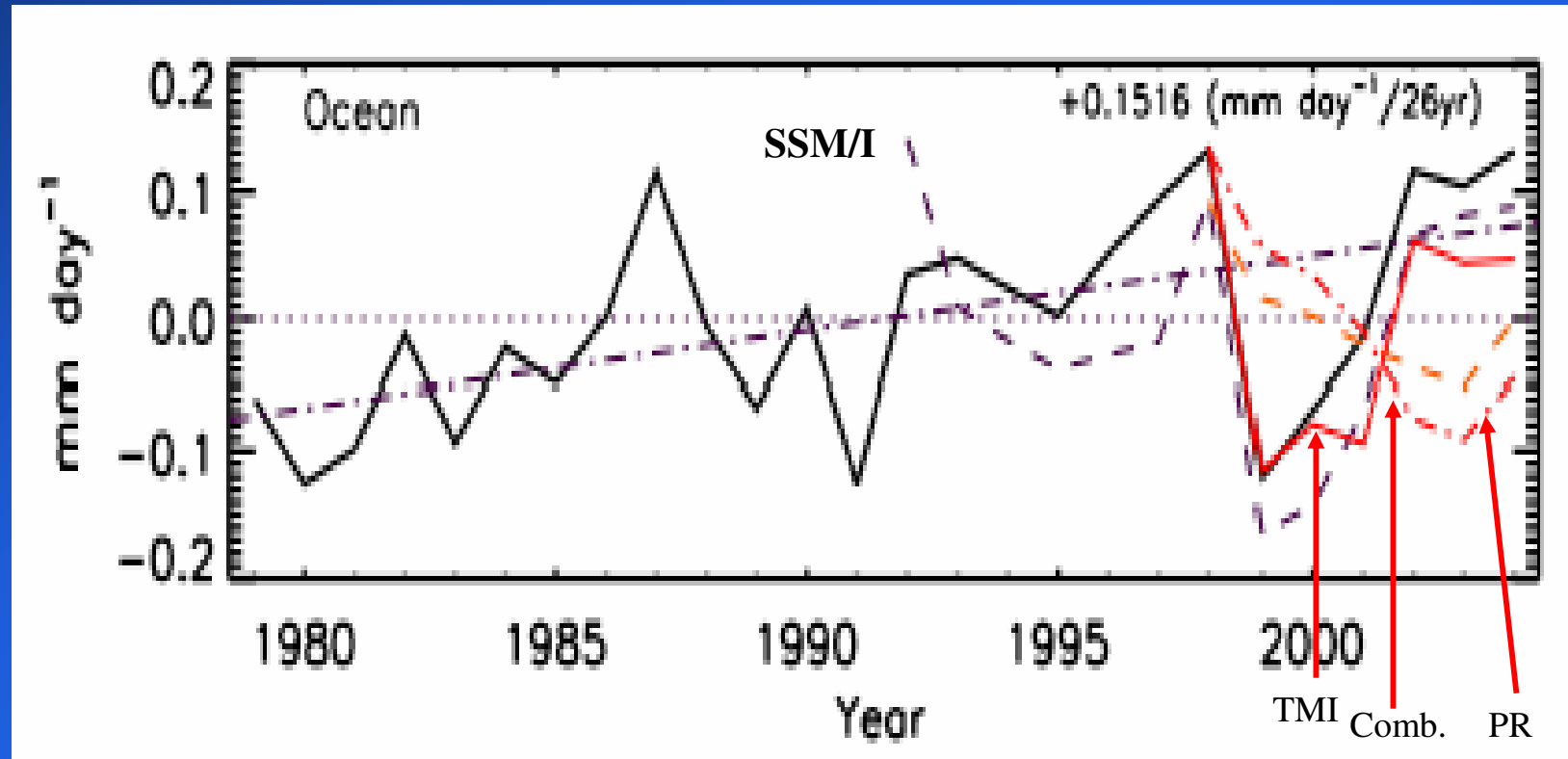
*Removal of ENSO and volcano variations*



*Slope without ENSO and volcano years: 3.7% change over period (confidence in 90-95% range).*



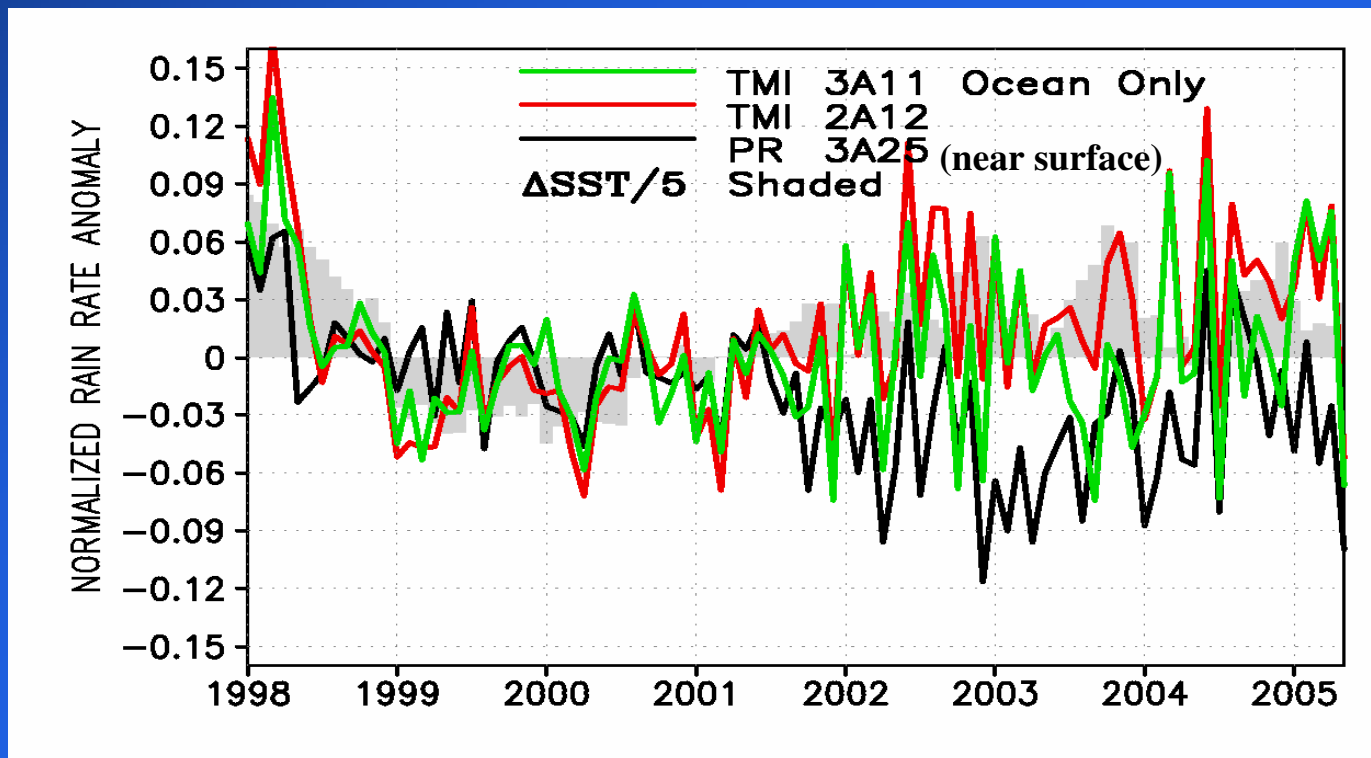
## Using TRMM data over 7 years as independent check on variations



- *TRMM passive microwave (TMI) confirms GPCP (although lower after TRMM boost in 2001)*
- *TRMM radar (PR) and Comb. show different variation*

# *TRMM Radar and Passive Microwave Observations Indicate Complexity of Retrievals and/or Physical Changes in Rain*

## *Ocean Only 30N-30S*



Averaged over the tropical oceans, TRMM passive algorithms (2A12 and 3A11) tend to track tropical SST anomalies; 2A25 does to a lesser degree and is biased low after the Aug 2001 orbit boost which reduces rainfall sensitivity of the radar. (2 km rain from PR less affected) TMI rain may also be affected by boost.

## *Global Precipitation Analysis for Climate and Weather Studies--Adler, Huffman, Gu, Curtis*

### **Data set needs**

- GPCP gridded analyses and input data sets
- TRMM individual data products (Precipitation Radar, passive microwave)
- TRMM 3-hr Multi-satellite (TMPA) [Version 6 product from Jan. 1, 1998-present]
- SSM/I precipitation products (GPROF, RSS, Chang-Wilheit), AMSR
- Gauge global-land precipitation data sets and analyses (GPCC, CRU, NOAA, etc.)
- Access to water vapor, cloud, evaporation, SST etc. data sets through collaboration

### **Project data set outputs**

- Improved climate-scale precipitation analysis (monthly, 1979-present) incorporating new data such as TRMM and AMSR, improved algorithms applied to the historical record, improved error information, in a form ready for water cycle integration studies
- Improved high time and space resolution precipitation analyses (at least 1998-present) for weather/climate studies, including extremes



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### **Potential collaborations** (with NSIT, other NEWS projects, etc.) :

- Sorooshian, Wentz, Olson and others on precipitation product evaluation/comparison and improvement
- Liu, Wielicki, Rossow, Curry, L'Ecuyer, Famiglietti, others on water cycle data sets
- Bosilovich, Soden, Roads, Schlosser, others on water cycle integration
- Rodell, Peters-Lidard, Betts, others on land-atmosphere interactions
- Shubert on extremes (droughts)

### **Important outside linkages/resources** (outside the NEWS team) :

- GPCP activity (NASA, NOAA, university, international group) under GEWEX/WCRP [assessment of current product, development of improved products].
- NASA Precipitation Measurement Missions (PMM) Science Team (TRMM/GPM) [TRMM and then GPM provide satellite observational backbone for future precipitation data sets]
- Int'l Precipitation Working Group (IPWG)--evaluation/improvement of high time resolution analyses

**Expected contribution to the NEWS objective:**

- An extended, improved global precipitation analysis for observational studies and model evaluation
- Uncertainty estimates for key precipitation characteristics, e.g., trends, inter-decadal changes
- A thorough evaluation of climate-critical variations in comparison with other water cycle data sets
- A significant contribution to understanding water cycle mean and variations through team studies

**Issues, needs, and concerns** (to be discussed in breakouts, teaming discussions, etc.):

- Intercomparison of water cycle data sets--each have problems, limitations--need to find period for evaluation of component interaction/feedback
- Many precipitation data sets for different periods for comparison
- Limitations in GPCP--high latitudes less accurate, orographic precipitation underestimated